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CHEMICAL EFFECTS

Volatile organic compounds (VOC) metabolites in urine are associated with increased systemic inflammation levels, and smokers are identified as a vulnerable population

2024-11-28

Background: Previous studies indicated that exposure to VOCs was linked to increased systemic inflammation levels. However, the dose-response relationships between urine VOCs metabolites and systemic inflammation have not been established, and the key metabolite of the toxic compounds has not been identified.

Methods: We used data in 7007 US adults in the NHANES cycles (2011-2018) across 8 years. Urinary VOC metabolites were measured using ultra-performance liquid chromatography and electrospray tandem mass spectrometry (UPLC-ESI/MSMS). VOC metabolites were adjusted by urinary creatinine level before analysis. Systemic inflammation was assessed by systemic immune-inflammation index (SII) and systemic inflammation response index (SIRI) indices. Generalized linear models, restricted cubic splines (RCS), and weighted quantile sum (WQS) regression were applied to evaluate the associations, exposure-response (E-R) curve and identify the key contributor compound, adjusting for gender, age, race, BMI, marital condition, education level, smoking level, alcohol consumption and physical activity. Smoking status was assessed as an effect modifier.

Results: Significant and robust positive correlations were found between 8 VOC metabolites and both SII and SIRI. They were N-Acetyl-S-(2-carboxyethyl)-L-cysteine (CEMA), N-Acetyl-S-(2-cyanoethyl)-L-cysteine (CYMA), N-Acetyl-S-(3,4-dihydroxybutyl)-L-cysteine (DHBMA), N-Acetyl-S-(3-hydroxypropyl)-L-cysteine (3HPMA), mandelic acid (MA), N-Acetyl-S-(4-hydroxy-2-butenyl)-L-cysteine (MHBMA3), phenylglyoxylic acid (PGA), and N-Acetyl-S-(3-hydroxypropyl-1-methyl)-L-cysteine (HPMMA). The RCS curves showed J-shaped or exponential shaped E-R relationships for most VOC metabolites. WQS regression found that exposure to the mixture of VOC metabolites was related to increased systemic inflammation, and MA was the key VOC metabolite contributing most to systemic inflammation levels. Smokers exhibited higher levels of urinary VOCs and larger susceptibility to VOC-related increases in SII and SIRI compared to non-smokers.

Conclusion: This study demonstrated a strong link between urinary VOC metabolites and increased systemic inflammation, and smokers were more

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susceptible. Our findings highlighted the significance of reducing VOC exposure to mitigate the inflammation levels, particularly for smokers.

Authors: Yuanzhuo Hu, Zhiping Niu, Changsheng Cao, Jun Gao, Miaoting Pan, Yunfei Cai, Zhuohui Zhao

Full Source: Ecotoxicology and environmental safety 2024 Nov 28:288:117398. doi: 10.1016/j.ecoenv.2024.117398.

ENVIRONMENTAL RESEARCH

The vertical transport and fate of MPs-oil composite pollutants in nearshore environment

2024-11-26

MPs-oil composite pollutants interact with particles to form MPs-oil-particles aggregates (MOPAs) in nearshore environment. In this study, we investigated vertical transport and fate of MPs-oil composite pollutants mediated by particles under various time scales, proposed and elucidated associated mechanisms. Majority of MPs with -CH₂ suspended in water columns and particles with Si-O and O-H adsorbed MPs-oil composite pollutants in sediment phase, which caused differences in morphology structure and composition. The MOPAs with spherical or irregular three-dimensional in water columns can transport to sediment phase, resulting in more than 79 % lamellar MOPAs and more than 63 % oil in sediment phase. Besides, we demonstrated that degraded small-sized MPs-oil composite pollutants can resuspend into water columns. The mass of n-alkanes in sediment phase (< 45 µg) was lower than in water columns (< 120 µg) during degradation process. More importantly, during the intermediate stage of degradation, the size of oil droplets on surface of MPs decreased and particles trapped them to sediment phase, resulting in a V-shaped curve of mass changes of C₁₄-C₃₅ in water columns. Our research fills the gap in the field of MPs-oil composite pollutants in water columns and sediment phase, which can provide theoretical support for their disposal.

Authors: Yuxiang Sun, Yuan Cheng, Xinping Wang, Ranran Dong, Yaqiu Yu, Jiaoxia Shi, Jinren Lu, Yiming Li, Mutai Bao, Haoshuai Li

Full Source: Journal of hazardous materials 2024 Nov 26:483:136661. doi: 10.1016/j.jhazmat.2024.136661.

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Association between acute exacerbation of chronic obstructive pulmonary disease and short-term exposure to ambient air pollutants in France

2024-11-29

Background: Ambient air pollution is recognized as a major risk factor for chronic obstructive pulmonary disease (COPD) which is the third leading cause of death worldwide. We examined whether variations in daily outdoor air pollutants levels were associated with excess hospital emergency room visits (ERV) for acute exacerbation of COPD (AECOPD).

Methods: This two-center ecological cohort study was conducted in Amiens, France. We collected all consecutive ERV for AECOPD throughout 2017 and developed single pollutant models to assess the association between AECOPD and nitrogen dioxide (NO₂), ozone (O₃), or particulate matter (PM_{2.5} and PM₁₀) levels, while adjusting for temperature, hygrometry, influenza circulation and pollen allergy risk. For a subgroup of patients, we also applied geographical modeling to analyze annual exposure to outdoor air pollutants.

Results: We recorded 240 ERV among 168 COPD patients in 2017 and identified 9 peaks of ERV. There was a statistically significant positive correlation between the daily ERV for AECOPD and the daily average concentrations of PM_{2.5} (RR = 1.06 (95%CI = [1.00-1.11]), p = 0.049), but no correlation with NO₂, O₃ or PM₁₀ (p = 0.073, p = 0.114 and p = 0.119, respectively). Our geographical modeling study revealed that long-term exposure to any of the four outdoor air pollutants was not associated with more frequent AECOPD.

Conclusion: Even though the pollution levels measured generally remained below or near the 2021 short-term air quality guidelines issued by the World Health Organization, significant aggregate-level associations were found between severe AECOPD leading to ERV and daily concentrations of PM_{2.5}.

Clinical trial registration: NCT03079661.

Authors: Damien Basille, Lola Soriot, Florence Weppe, Peggy Desmettres, Paulo Henriques, Nicolas Benoit, Stéphanie Devaux, Momar Diouf, Vincent Jounieaux, Claire Andrejak

Full Source: Environmental health: a global access science source 2024 Nov 29;23(1):107. doi: 10.1186/s12940-024-01146-3.

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Assessment of heavy metal concentrations, environmental risks and human health implications in marine sediments along the coastal ecosystems of the Republic of Congo

2024-11-30

The aim of this study is to assess the level of heavy metals (HMs) in surface sediments along the coastal estuaries of the Republic of Congo. A variety of approaches were employed, integrating elemental analysis (Atomique Absorption Spectroscopy), environmental, ecological, health risk assessment, and source identification techniques to evaluate the distribution, origin, environmental, ecological and health risks of potentially toxic element (PTE) contamination in sediments. The ascending mean concentration (mg/kg) of Cd (0.4) < Cu (18.6) < Pb (28.8) < Zn (62.1) < Mn (107) < Mg (569.6) complied with the local background, except for Cd and Pb. However, notable variations across sampling points and sites were observed, with a strong relationship between metals and organic matter. The comparing of PTEs with USEPA international standards and sediment toxicity guidelines showed compliance. The assessment of environmental risk parameters, based on the calculation of the geo-accumulation index, concentration factor and pollutant load indices showed low pollution of sediments. The ecological risk assessment, on the other hand, revealed a low level of pollution of biota and a low toxicity risk of ecosystems related to Cd and Pb and then to Cu in some sites. Regarding human health risk assessment, related to the PTEs, the cancerogenic effect indices were calculated for Cd and Pb through ingestion and inhalation pathways, and the non-cancerogenic effect indices were calculated for all HMs through ingestion, inhalation, and cutaneous contact routes, for children and adults, and showed that the results comply with the international standards set by USEPA, ranging from 10^{-4} to 10^{-6} and less than 1, respectively, where children were more sensitive and vulnerable than adults to the effects of the PTEs. Ultimately, this study revealed sediment lithology, anthropogenic activities, and mixed origins of HMs, with a large contribution from industrial activities. However, no significant impacts are discernible in the study area. In addition to the importance of this study, it forms part of the region database and could serve as a reference for future monitoring studies, since no data are available in the Congolese coastal environment.

Authors: Freddy Cacharel Kaya, Hasna Ait Bouh, Abdelmourhit Laissaoui, Guy Blanchard Dallou, Sanaa Said, Aimé Christian Kayath, Hilaire Elenga
Full Source: Environmental monitoring and assessment 2024 Nov 30;196(12):1279. doi: 10.1007/s10661-024-13420-5.

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PHARMACEUTICAL/TOXICOLOGY

Toxicokinetics of benzotriazole UV stabilizer UV-P in humans after single oral administration

2024-11-29

UV-P (2-(2H-Benzotriazol-2-yl)-p-cresol) is used as an ultraviolet (UV) light absorber in coating products, paints, adhesives, and sealants. Due to its widespread industrial and consumer uses, human exposure to UV-P is conceivable. In the study presented herein, initial data on its human in vivo metabolism were obtained for three study participants after single oral administration of 0.3 mg of UV-P/kg body weight. Urine and blood samples of two volunteers were collected up to 48 h after exposure. The third study participant donated urine and blood samples up to 72 h. Maximum levels of UV-P in blood of $184 \pm 36 \mu\text{g/l}$ ($85 \pm 3\%$ as conjugates) were reached 2.4 ± 1.2 h post-exposure. Maximum excretion rates of UV-P in urine of $2896 \pm 884 \mu\text{g/h}$ (completely conjugated) were reached 3.5 ± 1.1 h post-exposure. $37.2 \pm 5.4\%$ of the orally administered dose of UV-P was recovered in urine within 48 h post-exposure. The present study provides insight into the complex absorption, distribution, metabolism, and elimination (ADME) processes of benzotriazole UV stabilizers (BUVS). The study also demonstrates differences in the ADME between sterically hindered BUVS, such as UV-327 and UV-328, and sterically unhindered BUVS, such as UV-P, in which the phenolic hydroxyl group is readily accessible for conjugation with glucuronic acid or sulfate.

Authors: Corinna Fischer, Julia Hiller, Edgar Leibold, Thomas Göen

Full Source: Archives of toxicology 2024 Nov 29. doi: 10.1007/s00204-024-03907-y.

Contaminants of emerging concern in an endangered population of common eiders (*Somateria mollissima*) in the Baltic Sea

2024-11-28

Contaminants of emerging concern (CECs) are ubiquitous in aquatic environments and pose a range of biological effects including endocrine disruption. Yet, knowledge of their occurrence in wildlife including seabirds remains scarce. We investigated the occurrence of selected bisphenols, benzophenones, phthalate metabolites, benzotriazoles, benzothiazoles, parabens, triclosan, and triclocarban in plasma of 18 breeding female common eiders (*Somateria mollissima*) from an endangered population in the Baltic Sea as most of these CECs have

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never before been examined in eiders. We sampled blood at the start (T1) and end (T2) of incubation to investigate concentration changes during incubation. As early- and late-breeding eiders tend to differ in how they finance reproduction (local vs stored nutrient reserves), we compared early and late breeders to assess whether CEC concentrations differed by breeding phenology. Of the 58 targeted CECs, 21 were detected in at least one female, with bisphenol A (BPA) and benzophenone-3 (BzP-3) occurring most frequently (T1: 78% and 61%; T2: 61% and 67%, respectively), while mono(2-ethyl-1-hexyl) phthalate (mEHP), BPA, and monoethyl phthalate (mEP) were detected in the highest concentrations (median concentrations 27.1, 12.7, and 11.2 ng/g wet weight, respectively, at T1). No CEC concentrations differed between early and late incubation. Late breeders had significantly higher concentrations of BzP-3, monomethyl phthalate (mMP), and mEP during early incubation (4.55 vs 1.24 ng/g ww, 7.05 vs 3.52, and 11.2 vs < limit of detection (LOD), respectively) and significantly higher concentrations of mMP and mEP during late incubation (6.16 vs <LOD and 7.51 vs <LOD, respectively) than early breeders. We showed that early and late breeders exhibited differential exposure to CECs. Our results support the need for long-term monitoring of CECs in eiders. Furthermore, it is important to examine these CECs in the eiders' prey species from their wintering and breeding grounds.

Authors: Amalie V Ask, Veerle L B Jaspers, Junjie Zhang, Alexandros G Asimakopoulos, Sunniva H Frøyland, Juho Jolkkonen, Wasique Z Prian, Nora M Wilson, Christian Sonne, Martin Hansen, Markus Öst, Sanna Koivisto, Tapio Eeva, Farshad S Vakili, Céline Arzel

Full Source: Environmental pollution (Barking, Essex: 1987) 2024 Nov 28:365:125409. doi: 10.1016/j.envpol.2024.125409.

OCCUPATIONAL

Successful Strategies for Occupational Health and Safety in Small and Medium Enterprises: Insights for a Sustainable Return to Work

2024-12-01

Purpose: The objectives of this paper were to summarize successful strategies in occupational health and safety (OHS) management in small and medium-sized enterprises (SMEs) and to explore their potential applicability for disability management (DM) and return-to-work (RTW) after work-related injuries.

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Methods: A scoping review was conducted, using a consensus-based iterative approach, and a consultation with stakeholders. Twelve databases were searched in collaboration with a specialized librarian, using keywords and combinations of terms. The reviewers identified pertinent articles, selected those which corresponded to the inclusion criteria, extracted data, and analyzed information using qualitative content analyses. A synthesis was presented to the stakeholders, and their comments on overall applicability of these strategies in the Quebec context of DM and RTW were detailed.

Results: A total of 638 references were retrieved from all sources, resulting in 37 scientific articles being analyzed. Four main strategies for improving OHS management in SMEs were identified: dissemination and exchange of information; transmission and acquisition of knowledge, skills, and abilities; using a participatory and collaborative approach; and considering the organizational context. Even if DM and sustainable RTW were sometimes mentioned by authors as important for OHS management in SMEs, specific strategies and implementation elements were not actually described by authors. However, different resources, structures, and activities, associated with one or more of the OHS management strategies described, through their different interactions between the various stakeholders, seem having the potential to act also in sustainable RTW.

Conclusion: This review has provided an overview of strategies deployed to improve OSH in SME. The results invite stakeholders to a deep reflection on the potential application of such strategies to encompass sustainable RTW in SMEs.

Authors: Iuliana Nastasia, Romain Rives

Full Source: Journal of occupational rehabilitation 2024 Dec 1. doi: 10.1007/s10926-024-10255-2.

Association between exposure to arsenic, cadmium, and lead and chronic kidney disease: evidence from four practical statistical models

2024-11-30

Background: Environmental exposure to arsenic (As), lead (Pb) and cadmium (Cd) may cause chronic kidney disease (CKD), with varying independent effects and unclear combined impact. This study aimed to evaluate these effects on CKD.

Methods: 1,398 individuals were included. Urine arsenic (UAs) was determined by atomic fluorescence method. Urinary cadmium (UCd) and blood lead (BPb) levels were determined by graphite-furnace atomic absorption spectrometry. CKD was defined as an estimated glomerular

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filtration rate (eGFR) < 60 mL/min/1.73m² or proteinuria. Generalized linear models (GLM), restricted cubic spline (RCS) models, weighted quantile sum (WQS) regression, and Bayesian kernel machine regression (BKMR) models were employed to study the independent and combined effects of exposure to As, Pb and Cd on CKD risk.

Results: Compared with non-CKD subjects, UAs, UCd, BPb, and creatinine adjusted urinary cadmium (UCdCr) were all significantly higher in CKD subjects. Compared with the lowest quartiles, the ORs (95%CI) of CKD risk in the highest quartiles were 2.09 (1.16-3.74) for UAs, 2.84(1.56-5.18) for UCd, and 1.79 (1.05-3.06) for UCdCr, respectively. UAs, UCd, and UCdCr were all significantly positively associated with CKD risk in p-trend tests. RCS models revealed non-linear links between UAs, UCd, UCdCr and CKD risk, while a linear dose-response existed for BPb and CKD risk. The OR (95%CI) in WQS models were 1.72 (1.25-2.36) with UAs being the highest weighing metal(loid). BKMR models showed co-exposure mixture linked to higher CKD risk when the ln-transformed metal(loid)s above their 55th percentile. The ln-transformed UAs and UCdCr was significantly positively associated with CKD risk when the other two ln-transformed metals levels were all fixed at their different percentile levels. Synergism between Cd and Pb was also apparent.

Conclusions: Single As, and Cd exposure were positively associated with an increased CKD risk. Co-exposure to As, Pb and Cd was positively associated with CKD risk, with As playing a dominant role.

Authors: Jiongli Huang, Jingying Mao, Huilin Liu, Zhongyou Li, Guiyun Liang, Dabiao Zhang, Junchao Yang, Wen Qin, Pingjing Wen, Yueming Jiang, Zhaoyu Mo

Full Source: Environmental geochemistry and health 2024 Nov 30;47(1):6.
doi: 10.1007/s10653-024-02318-3.

Prevalence of occupational noise-induced hearing loss and its associated factors among marine technicians working on the Royal Malaysian Navy vessels

2024-11

Introduction: Noise-induced hearing loss (NIHL) is the second most common form of sensorineural hearing loss. It is one of the occupational health concerns worldwide with a prevalence rate of 16%. In Malaysia, there is an increasing trend of occupational NIHL prevalence encompassing agriculture, manufacturing, transportation, and construction sectors. The Malaysian Armed Forces (MAF) personnel, particularly the marine technicians of the Royal Malaysian Navy (RMN), have a heightened risk of developing NIHL due to prolonged exposure

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to hazardous noise levels onboard the military vessels. Previous studies involving MAF participants recorded a prevalence rate of approximately 22%. However, limited information is available regarding occupational NIHL among the RMN marine technicians. This study aimed to determine the prevalence of occupational NIHL and its associated factors among marine technicians working on the RMN vessels.

Materials and methods: A cross-sectional study was conducted among 127 randomly selected participants among marine technicians working on RMN vessels stationed at the Lumut Naval Base, Perak, Malaysia. The research instruments were questionnaires that contained information about sociodemographic, socioeconomic, occupational characteristics, and lifestyle behaviours, followed by a pure tone audiometric (PTA) assessment. Diagnosis of NIHL was made when the hearing threshold was ≥ 25 dB at 3 kHz to 6 kHz, with a recovery at 8 kHz on PTA.

Results: The participants' median age was 32 years (interquartile range=27-37 years). The prevalence of occupational NIHL was 29.9% (95% CI=22.1-38.7). Factors associated with occupational NIHL on unadjusted regression analysis include age >30 years (OR=2.56, $p=0.0185$), middle household income (OR=2.76, $p=0.0227$), military rank especially the warrant officer (OR=7.12, $p=0.0038$), and length of service ≥ 15 years (OR=2.40, $p=0.0246$). After adjusting for ethnicity, smoking status, types of vessels, and participation in noise-related leisure activities, middle household income (OR=3.15, 95% CI=1.29- 7.87, $p=0.0121$) and warrant officer (OR=4.38, 95% CI=1.08- 20.52, $p=0.0384$) remained as significant predictors for occupational NIHL in this population.

Conclusion: In this study, the marine technicians working on board the RMN vessels had a higher prevalence of occupational NIHL compared to the prevalence among other MAF personnel as well as the global data. In addition, the probabilities of having occupational NIHL were significantly higher for middle-income technicians and those who ranked as warrant officers. These findings highlight the need for routine audiometric assessment and adoption of hearing conservation initiatives for individuals at high risk within this occupational cohort.

Authors: W M M Wan Mohamed, S H Adam, K A Zarkasi, S Z Zulkepli
Full Source: The Medical journal of Malaysia 2024 Nov;79(6):669-676.